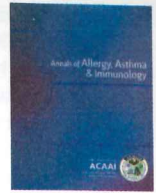




ELSEVIER



What affects quality of life among caregivers of food-allergic children?



Laura Howe, MD*; Timothy Franxman, MD^{*,†}; Esther Teich, MA*; and
Matthew Greenhawt, MD, MBA, MSc*

*The University of Michigan Food Allergy Center, Division of Allergy and Clinical Immunology, University of Michigan Health System, Ann Arbor, Michigan

†Family Allergy & Asthma, Florence, Kentucky

ARTICLE INFO

Article history:

Received for publication February 5, 2014.

Received in revised form April 16, 2014.

Accepted for publication April 21, 2014.

ABSTRACT

Background: Food allergy is associated with decreased caregiver quality of life (QoL). The influence of accurate reaction perception, allergen, and sociodemographic factors on caregiver QoL is poorly understood. **Objective:** To determine factors influencing caregiver food allergy QoL within an academic center cohort. **Methods:** Caregivers of children allergic to milk, egg, peanut, or tree nut evaluated from 2009 to 2011 completed a questionnaire assessing the details of the children's most severe food reaction and caregiver QoL using the Food Allergy Quality of Life–Parental Burden index. Survey responses were verified through chart review. A multiple linear regression model was used to determine factors influencing QoL score.

Results: Of 305 caregivers surveyed, 65% had accurate reaction perception. This was higher in caregivers of children with provider-confirmed anaphylaxis ($P = .008$). Milk or egg allergy was associated with higher total and independent domain-specific QoL scores compared with peanut or tree nut allergy, and an income lower than \$50,000 was associated with higher total QoL scores and higher scores for 5 of 17 individual domains. In a linear regression model, age at most severe reaction (-0.02 , $P = .01$), peanut or tree nut allergy (-0.81 , $P = .004$) and milk allergy (-1.12 , $P = .001$) vs egg allergy, income higher than \$50,000 (-0.53 , $P = .04$), multiple food allergies (0.45 , $P = .007$), accurate reaction perception (-0.37 , $P = .04$), eczema ($+0.49$, $P = .004$), and caregiver report that the child had anaphylaxis ($+0.48$, $P = .02$) were significantly associated with QoL score.

Conclusion: Food allergen, having multiple food allergies, age at reaction, income, eczema, parent-reported anaphylaxis, and reaction perception can significantly affect caregiver food allergy QoL. Milk or egg allergy was associated with worse total and domain-specific caregiver QoL scores vs peanut or tree nut allergy, representing a high-risk subgroup.

© 2014 American College of Allergy, Asthma & Immunology. Published by Elsevier Inc. All rights reserved.

Introduction

Food allergy affects an estimated 8% of children in the United States.^{1,2} Multiple studies have shown that food allergy has a negative effect on caregiver and patient quality of life (QoL).^{3–8} Although food allergy has a low mortality rate and a low risk for recurrence of symptoms with caregiver or individual vigilance, psychological

symptoms can develop due to the constant burden of a potential for a severe reaction, which negatively affects food allergy health-related QoL.⁹ Allergen avoidance, the only present food allergy option, is associated with decreased caregiver QoL through a perceived burden of responsibility and hypervigilance.^{3–8} Parents may lack the preparation to manage exclusion diets or the appropriate training to administer epinephrine when needed.^{10,11}

Food-induced anaphylaxis is the most common type of anaphylaxis in children^{12,13} and is responsible for an estimated 150 deaths annually in the United States.¹⁴ Prompt, accurate diagnosis of food-related anaphylaxis is important to facilitate swift epinephrine treatment.^{15,16} Families may inconsistently recognize the symptoms of an allergic reaction constituting anaphylaxis. Studies have shown that only one third of initial food reactions with symptoms of anaphylaxis are treated appropriately.^{17,18} There are limited data evaluating the effect of an accurate perception of a child's food allergy reaction on caregiver QoL. This is important because studies have noted QoL in food-allergic children is similarly impaired,^{4,19} and that a child with food allergy may increase caregiver anxiety.⁷ Moreover, associated atopic diseases negatively affect the general

Reprints: Matthew Greenhawt, MD, MBA, MSc, 24 Frank Lloyd Wright Drive, PO Box 442, Suite H-2100, Ann Arbor, MI 48106; E-mail: mgreenha@med.umich.edu.

Disclosure: Dr Greenhawt is an associate editor of the *Annals of Allergy, Asthma, and Immunology*; has consulted for Deerfield Industries and Frankel Group; served as speaker for the European Academy of Allergy and Clinical Immunology, Canadian Society of Allergy and Clinical Immunology, and American College of Allergy, Asthma and Immunology; received funding from the National Institutes of Health (grant 2KL2TR000434); provided nonfinancial testimony for the Michigan State Medical Society; and served without remuneration as medical chair for the Food Allergy and Anaphylaxis Connection Team and Medical Advisory Board for Kids With Food Allergy and the International Association for Food Protein Enterocolitis.

Funding: Funding for the study was provided by the University of Michigan Food Allergy Center and in part by grant UL1RR024986 from the National Center for Research Resources.

health perception of the food-allergic child and increase caregiver anxiety.^{3,20,21} A history of perceived anaphylaxis also has been associated with higher scores of anxiety and distress.^{7,22} However, it is unclear whether anxiety and poor QoL are influenced by misperception of the child's reaction severity, the type of allergy (eg, peanut vs egg), or other health care disparities that act as social stressors. Therefore, the objective of this study was to evaluate the effect these factors have on caregiver food allergy QoL within an academic clinic population using the Food Allergy Quality of Life—Parental Burden (FAQL-PB) form (eTable 1).²³

Methods

Study Design

Caregivers of milk-, egg-, peanut-, or tree nut-allergic children evaluated and managed at (University of Michigan Food Allergy Center and divisional Allergy Clinics) from 2009 to 2011 were identified by the review of a divisional food allergy patient database and recruited for participation in this clinical study by mail or by telephone from November 2011 through August 2012. These 4 allergens were specifically selected because they represented the most common food allergens seen in the practice. The inclusion criteria for the study included a patient care visit in the clinic from 2009 to 2011 (as a new patient or for follow-up) and a chart-verified diagnosis of food allergy. Food allergy was defined by a documented, convincing clinical history of an IgE-mediated food-induced allergic reaction in the setting of confirmed IgE-mediated sensitization to the reported food (positive skin test result and/or positive sIgE level) or sIgE and/or a prick skin test wheel with a greater than 95% positive predictive value for milk, egg, or peanut allergy in a child with atopic dermatitis.²⁴ Patients in the database without milk, egg, peanut, or tree nut allergy were excluded. Allergen skin and serum testing results were directly abstracted from the medical record through chart review. To assess reaction perception, caregivers completed a questionnaire regarding symptoms of the child's most severe reaction to the allergen, reaction treatment, follow-up care of food allergy, allergic and nonallergic comorbidities, anaphylaxis management training, sociodemographic information (eg, sex, self-reported race or ethnicity, self-reported combined family income, reported age at onset of allergy and most severe reaction, allergic comorbidities including other food allergy, reported perception of reaction severity, etc) and the FAQL-PB assessing caregiver QoL.

The caregiver-reported questionnaire data were verified through chart review of the patient's medical record to account for potential recall bias. National Institute of Allergy and Infectious Diseases and Food Allergy and Anaphylaxis Network anaphylaxis criteria were applied to the parent-reported symptoms and those detailed through chart review.²⁵ Caregiver perception of reaction severity was rated as a dichotomous variable assessing whether the caregiver had identified the food that produced the child's most severe reaction that resulted in anaphylaxis. Accurate perception was defined as parent perception of anaphylaxis being concordant with the provider rating of anaphylaxis based on the reported symptoms meeting the National Institute of Allergy and Infectious Diseases and Food Allergy and Anaphylaxis Network criteria, with inaccurate perception defined as under- or over-perception. The FAQL-PB is a 17-item self-administered questionnaire that measures the effect of pediatric food allergy on caregiver QoL, developed by Cohen et al²³ and validated in a caregiver report and a clinic-verified population of caregivers. It has a reported Cronbach α of 0.95 as a reliability measurement. The QoL was not assessed at a uniform time from diagnosis in the caregiver during the formulation and validation of this scale.²³ Each of the 17 questions is a 7-point Likert item and the index is scored as a summated rating scale, with a higher FAQL-PB score indicating a worse QoL.

Statistical Analysis

Data were analyzed using frequency analysis to report descriptive statistics. Inferential analysis at a bivariate level was made using χ^2 test, Kruskal-Wallis test, and Student *t* test. An adjusted multiple linear regression model was used to explore the relation between the main outcome of QoL score and how this is influenced by several covariates. Multiple adjusted linear regression models the effects that a 1-unit change in the independent variable has on a 1-unit increase in the dependent (outcome) variable. No backward stepwise selection of predictor variables was used, and analysis was prespecified based on an previous pilot study of reaction perception in egg-allergic children.²⁶ Multicollinearity of independent variables was assessed using inspection of the variance inflation factor, and model specificity was assessed through the STATA linktest (model specification link assessment) and *ovtest* (Ramsey reset test for omitted variables) commands.

The clinical significance of changes in QoL measurements can be assessed through evaluating a minimal clinical important difference (MCID), defined as the smallest difference in score that patients perceive as beneficial, and would mandate, in the absence of troublesome side effects and effective cost, a change in the patient's management. For 7-point Likert scales analyzing QoL, prior studies have used an approximate measurement of 0.5 for the MCID, based on work by Jaeschke et al.²⁷ However, an MCID of 0.5 is not an absolute number adaptable to any 7-point scale, because the MCID is considered specific to the particular QoL index and to the population being surveyed.^{28,29} Therefore, no true MCID is known for the FAQL-PB, and an MCID of 0.5 for the index (as previously used in its validation) is speculative.^{9,23,30}

Data³¹ were analyzed with STATA IC, version 12 (STATA Corp, College Station, Texas). Based on a level of significance of .05, the study had 80% power to detect a 0.5 difference in QoL score with 65 patients per arm. This study was approved by the (University of Michigan Medical School) medical school institutional review board.

Table 1
Demographics and characteristics (n = 305)

Male patients, % (n)	62.3 (190)
Food triggering most severe reaction, % (n)	
Peanut	24.6 (75)
Tree nut	28.2 (86)
Egg	26.9 (82)
Milk	20.3 (62)
White race, % (n)	78.7 (240)
Household income <\$50,000 (n = 270), % (n)	12.1 (37)
Has >1 food allergy, % (n)	56.1 (171)
Atopic dermatitis, % (n)	57.4 (175)
Asthma, % (n)	39 (119)
Allergic rhinitis, % (n)	25.2 (77)
Sibling with food allergy, % (n)	23.6 (72)
Other nonallergic chronic illness, % (n)	4.6 (14)
Baseline allergen sensitization	
Initial peanut SPT wheal (mm), median	8
Initial almond SPT wheal (mm), median ^a	1
Initial cashew SPT wheal (mm), median ^a	7
Initial walnut SPT wheal (mm), median ^a	3
Initial egg SPT wheal (mm), median	5
Initial milk SPT wheal (mm), median	9
Initial peanut ImmunoCAP (kU _A /L), median	8.9
Initial almond ImmunoCAP (kU _A /L), median ^a	0.35
Initial cashew ImmunoCAP (kU _A /L), median ^a	2.5
Initial walnut ImmunoCAP (kU _A /L), median ^a	0.36
Initial egg ImmunoCAP (kU _A /L), median	3.2
Initial milk ImmunoCAP (kU _A /L), median	8.2

Abbreviation: SPT, skin prick test.

^aLimited tree nuts listed for simplicity.

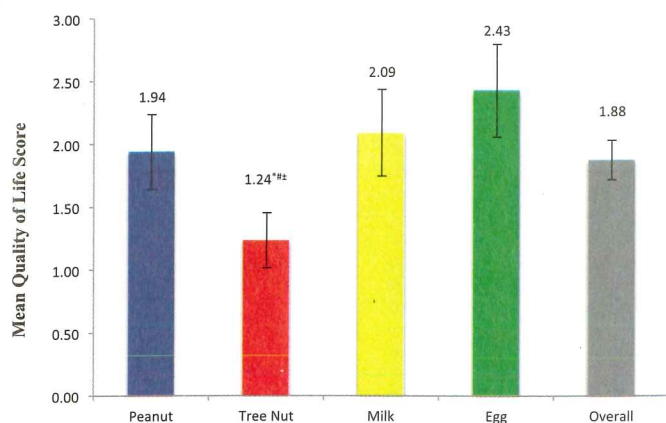


Figure 1. Comparison of mean quality of life (QoL) scores for each allergen and the overall study population. Increased scores indicate worse QoL. Error bars reflect the 95% confidence interval. * $P = .001$ vs peanut allergy, # $P = .001$ vs milk allergy, $^{\ddagger}P < .0001$ vs egg allergy.

Results

Baseline Demographic Characteristics, Most Severe Reaction, and Medical History

Data were analyzed for 305 caregivers of children with peanut ($n = 75$), tree nut ($n = 86$), egg ($n = 62$), or milk ($n = 82$) allergy. Mothers completed 90.8% of the caregiver reports, fathers 8.8%, and other caregivers 0.003%. Nearly all caregivers were high school graduates (97.3%) and 81.6% of caregivers had graduated from college. The median age of the children at the time of survey was 6.6 years, the median age of the child's initial reaction was 15.5 months, and the median age at the child's most severe food reaction was 20 months. Baseline demographic information, including median egg white, peanut, cow milk, and tree nut ImmunoCAP and skin test wheal results, in addition to the underlying allergic comorbidities are presented in Table 1.

A history of food-induced anaphylaxis was noted by chart review in 44.7% of children ($n = 136$), although on the questionnaire only 36.7% of caregivers ($n = 112$) reported that this had occurred. Parent report and provider (chart review) diagnosis of anaphylaxis were concordant in 60% of cases ($n = 80$). In 64.6% of children ($n = 197$), their most severe reaction was the initial reaction to the index food allergen. Only 18.6% of caregivers ($n = 57$) reported their child

had received epinephrine as treatment for what was identified as the child's most severe reaction, including just 40.9% of those who reported their child had anaphylaxis. There were 16.4% of caregivers ($n = 50$) who reported their child went untreated during the most severe reaction.

Study Population Characteristics of the FAQL-PB Index

The FAQL-PB index had a Cronbach α coefficient of 0.96 in this population, indicating high reliability (eFig 1, FAQL-PB questions). Overall mean QoL score in the population was 1.88, which indicates a fairly good QoL. Caregivers reported the highest (eg, worse QoL) mean item-specific QoL scores for dining out, trusting others, others not appreciating the seriousness of food allergy, and their child attending school or camp. The least troublesome areas concerned nutrition, leaving the home, additional time needed to prepare for mealtime, and ensuring a normal upbringing (eFig 1).

Effect of Parental Reaction Misperception on Food Allergy QoL

Only 64.2% ($n = 196$) accurately perceived the severity of their child's reaction, with 15.6% over-perceiving their child's reaction severity and 19.3% under-perceiving the reaction severity. Accurate perception was greater in caregivers of children with provider-confirmed anaphylaxis (56.3% vs 43.7%, $P = .008$), although accurate perception did not entirely depend on the allergen. Overall, mean QoL score was not significantly different based on accurate caregiver reaction perception at a bivariate level, except when exploring specific differences in scores in caregivers of peanut-allergic children. Mean QoL score was lower in caregivers of peanut-allergic children for accurate vs inaccurate reaction perception (1.7 vs 2.3, mean difference 0.64, $P = .03$). There was no significant difference in mean QoL score between those who over-perceived vs under-perceived reaction severity, and there were no allergen-specific effects between these groups. In comparing individual QoL domains based on reaction perception, some differences were noted. In caregivers with inaccurate reaction perception, the domain-specific QoL scores were significantly higher for caregiver worry about the ability to help in the event of a reaction (mean difference 0.5) and for feeling troubled regarding others having a lack of appreciation for the seriousness of food allergy (mean difference 0.48) compared with caregivers with accurate perception.

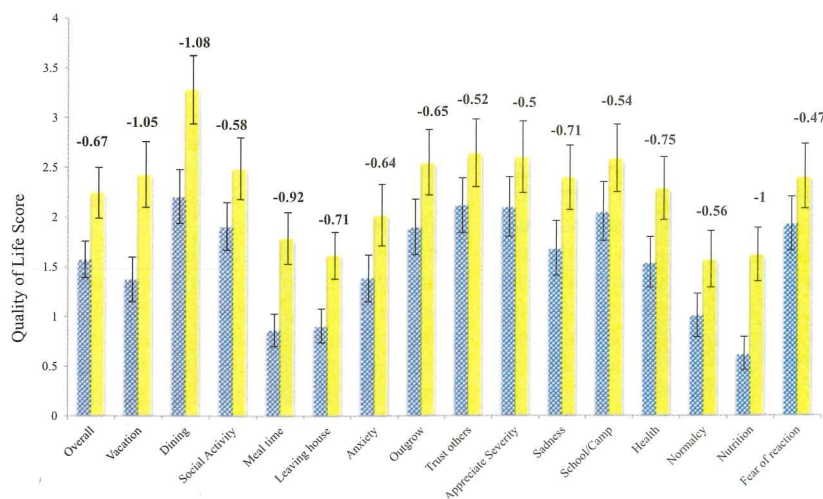


Figure 2. Domain-specific quality of life (QoL) by allergen (peanut or tree nut vs milk or egg). Error bars reflect the 95% confidence interval. The mean difference per domain between groups is denoted, and all comparisons shown are statistically significant at $P \leq .05$.

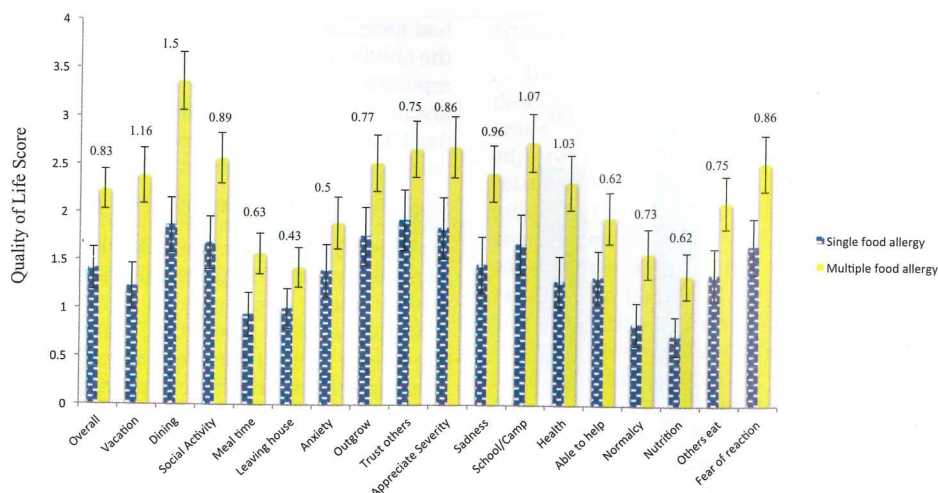


Figure 3. Domain-specific quality of life (QoL) stratified by single vs multiple (>1) food allergies. Error bars reflect the 95% confidence interval. The mean difference per domain between groups is denoted, and all comparisons shown are statistically significant at $P \leq .05$.

Effect of Food Allergen on Food Allergy QoL

Mean QoL scores were significantly different based on food allergen type (Fig 1). Caregivers of children allergic to tree nut had significantly lower mean QoL scores compared with those of children allergic to peanut (mean difference 0.7, $P = .001$), milk (mean difference 0.85, $P = .001$), and egg (mean difference 1.19, $P < .0001$), but otherwise no other differences were seen in caregivers of children allergic to egg, milk, or peanut. When comparing caregivers of milk- or egg-allergic children with those of peanut- or tree-nut allergic children, caregivers of milk- or egg-allergic children had a significantly higher mean QoL score (2.24 vs 1.56, mean difference 0.67, $P < .0001$) and significantly higher QoL scores for all 17 individual domains (Fig 2). This effect also was significant in a simple linear regression model adjusting for the presence of multiple food allergies, which showed that the effect for milk or egg allergy compared with peanut or tree nut allergy was associated with a 0.48 increase in QoL score ($P = .002$, 95% confidence interval, 0.18–0.8). These allergen pairings were chosen based on differing perceptions of allergy duration (one is believed to be outgrown in childhood vs the other is believed to persist lifelong), which was an

a priori concern that could affect QoL. Mean total QoL score and all 17 domain-specific QoL scores were significantly higher in caregivers reporting children with multiple (>1) food allergies vs those with just 1 food allergy (mean score 2.24 vs 1.41, $P < .001$; Fig 3).

Effect of Health Disparities on Food Allergy QoL

The QoL scores were stratified further for additional subgroup analyses. Caregivers reporting their child had a history of anaphylaxis had significantly higher mean QoL scores than those whose child did not have a history of anaphylaxis (2.1 vs 1.7, mean difference 0.42, $P = .01$), and higher QoL scores for 8 of 17 individual domains (Fig 4). In addition, caregivers reporting an income lower than \$50,000 had a significantly higher mean total QoL score (2.4 vs 1.8, mean difference 0.6, $P = .02$) vs those with an income higher than \$50,000 and a significantly higher QoL score for 5 of 17 individual domains (Fig 5).

A multiple linear regression model was created to evaluate the specific factors that could influence caregiver food allergy QoL (Table 2). Total QoL score was significantly associated with accurate

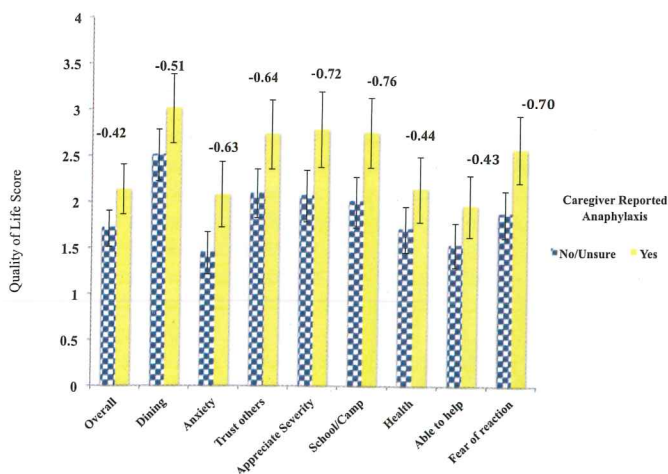


Figure 4. Domain-specific quality of life (QoL) by caregiver-reported anaphylaxis. Error bars reflect the 95% confidence interval. The mean difference per domain between groups is denoted, and all comparisons shown are statistically significant at $P \leq .05$.

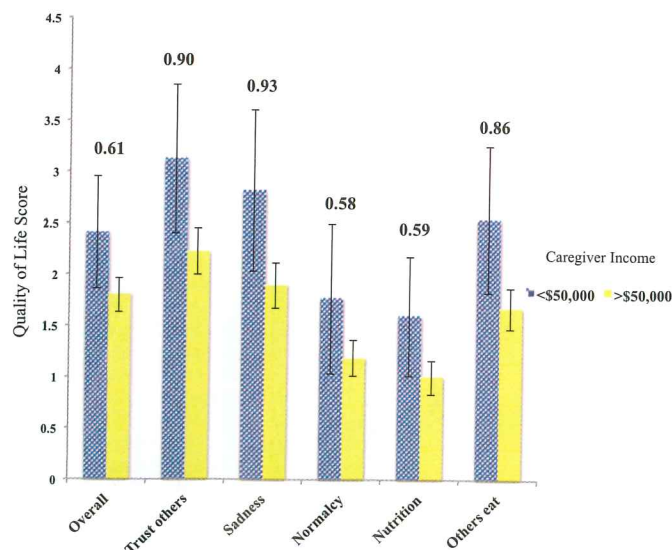


Figure 5. Domain-specific quality of life by income. Error bars reflect the 95% confidence interval. The mean difference per domain between groups is denoted, and all comparisons shown are statistically significant at $P \leq .05$.

Table 2
Caregiver associations with Food Allergy Quality of Life—Parental Burden score

Predictor variable	Coefficient	P value	95% CI
Age of most severe reaction	−0.02	.01	−0.03 to 0.004
Egg-allergic child (reference)	1		
Peanut or tree nut	−0.81	.004	−1.36 to −0.25
Milk	−1.12	.001	−1.8 to −0.46
Allergen × age interaction (egg reference)	1		
Peanut or tree nut × age of reaction	0.01	.1	−0.002 to 0.02
Milk × age of reaction	0.04	.002	0.01 to 0.06
Graduated from college	0.01	.95	−0.42 to 0.45
White race	0.13	.54	−0.28 to 0.53
Other food-allergic siblings	−0.14	.45	−0.51 to 0.23
>1 food allergy	0.45	.007	0.12 to 0.78
Income >\$50,000	−0.53	.04	−1.03 to −0.02
Reported respiratory symptoms	0.1	.6	−0.28 to 0.49
Reported gastrointestinal symptoms	−0.29	.09	−0.63 to 0.05
Reported cardiovascular symptoms	0.3	.52	−0.62 to 1.23
Reported skin symptoms	−0.02	.94	−0.46 to 0.42
Most severe reaction treated with epinephrine	0.08	.73	−0.36 to 0.52
Comorbid eczema	0.49	.004	0.16 to 0.82
Comorbid asthma	0.03	.86	−0.33 to 0.4
Correct reaction perception	−0.37	.04	−0.73 to −0.02
Caregiver-reported anaphylaxis	0.48	.02	0.09 to 0.87
Child's current age	−0.09	.4	−0.28 to 0.11
Age × age interaction (nonlinear effect)	0.006	.25	−0.004 to 0.02
Intercept	2.7	<.001	1.78 to 3.78

Abbreviation: CI, confidence interval.

reaction perception (decreased QoL score), older age at most severe reaction (decreased QoL score), egg allergy (increased QoL score vs milk or peanut or tree nut allergy), more than 1 food allergy (increased QoL score), higher income (decreased QoL score), and caregiver-reported anaphylaxis and comorbid eczema (increased QoL scores, respectively). There was an interaction noted in that, compared with egg allergy, caregiver QoL scores of children allergic to peanut or tree nut and milk increased with an older age at the initial reaction (ie, worsening of the QoL was enhanced by older onset of the allergy). In a sensitivity analysis that included reaction perception as a 3-level term (accurately perceived, over-perceived, under-perceived), there was no significant effect of caregiver under-perception vs over-perception of reaction severity on total QoL score, and in using this variable there was no change in the R^2 of the model compared with using reaction perception as a bivariate term (accurate vs inaccurate perception). Therefore, the latter model was retained using reaction perception as a bivariate term. Model specification linkage test and Ramsey reset test for omitted variables were nonsignificant, indicating the model was properly specified.

Discussion

This study comprehensively demonstrates that the effects of caregivers' perception of the severity of their child's reaction, food allergen type, and several sociodemographic factors can influence QoL in caregivers of food-allergic children. The authors note 2 novel findings with respect to the effect of specific food allergens: that accurate perception of reaction severity in caregivers of peanut-allergic children was associated with a lower QoL score (eg, better) and that caregivers of milk- or egg-allergic children had a significantly higher total mean QoL score and significantly worse QoL scores (higher scores) for all 17 individual QoL domains compared with caregivers of peanut- or tree nut-allergic children. In a more comprehensive, adjusted multiple regression model, the authors identified several factors in addition to allergen type that were associated with significant increases or decreases in the QoL score, including accurate reaction severity perception, age at the child's most severe reaction, multiple food allergies, income,

caregiver report of the child having had anaphylaxis, and comorbid eczema.

Given the positive influence of accurate reaction perception and the independently significant negative influence of caregiver-reported anaphylaxis, there is urgency to ensure caregivers are properly educated to assess reaction severity at the time of diagnosis. The known association between a child's food-induced anaphylaxis and parental negative psychological impact suggests this is a critical window within which to properly train and conceptually cement an accurate assessment of reaction severity (and its implications) and correct any misperceptions.³² How to accomplish this is less clear, and there are scant data suggesting a good solution. The authors successfully demonstrated in a randomized controlled trial that a self-regulation educational program can help improve caregiver QoL but are not aware of other such proven interventions.³³ This study did not explore factors influencing inaccurate reaction perception, but further qualitative or mixed-method studies may show such influences and help direct specific targets for intervention. The authors speculate that improving the understanding of what is and what is not anaphylaxis, that large positive skin or blood test results or the numbers of sensitizations do not infer any clinical significance to the severity of a reaction, and that targeting anxiety surrounding the use of self-injectable epinephrine would help. A self-regulation intervention may be of value to help moderate these themes. The aforementioned factors influencing QoL identified in this study also should be considered in tailoring any education provided to the family.

The present data that caregivers of milk- or egg-allergic children had worse QoL than those of peanut- or tree nut-allergic children are novel and withstood adjustment for the presence of multiple food allergies. Although there may be a common community perception that peanut and tree nut allergies are more severe and pervasive than milk or egg allergy, it is not surprising that caregivers of milk- or egg-allergic children may have worse QoL. Milk and egg are ubiquitous in the US diet, which can increase the difficulty of avoidance and negatively affect QoL through increased anxiety and stress related to the greater burden of vigilance. Data reporting that 72% of a referral center cohort of milk- or egg-allergic infants 3 to 15 months old had an additional allergic reaction to milk or egg in a 3-year period is evidence of how difficult avoidance can be.³⁴ However, detailed future study is needed to better explore what can influence such an allergen-related QoL effect.

This study has several limitations. This was a retrospective study, taken from a largely white and well-educated population seen at a tertiary-referral center, and is not necessarily representative of the general US food-allergic population. It is also limited by recall bias in the use of a parent questionnaire for gathering certain data, which could have influenced misperception. However, use of chart review for verification of information should mitigate that bias somewhat. The regression model is exploratory and based on variables selected from previous data from a pilot study exploring reaction perception in caregivers of egg-allergic children.²⁷ Although the model is properly specified from the available variables, there certainly are other significant factors that might not have been assessed or measured that could influence a QoL score, and thus further research is warranted to expand and refine this model. The FAQL-PB is a validated caregiver QoL index, but it lacks a specific MCID.²³ Instead, the authors used a generic MCID of 0.5 cited in the analyses of other nonallergy health-related QoL questionnaires compiled from a series of 7-point Likert items.^{27,35} Therefore, 0.5 is a speculative rather than an exact value and might not be the appropriate value for the FAQL-PB. Thus, disregarding a difference between groups because it did not exceed a generic MCID of 0.5 may be short-sighted given no established index-specific MCID.³⁰ For this reason, the authors reported all statistically significant differences for the QoL score comparisons.

Moreover, the FAQL-PB, like many QoL indices, has a limited recall period and a focusing effect, which could alter responses. The QoL in this study was not measured at a uniform period of time (eg, at diagnosis or at a specified time from diagnosis). However, the FAQL-PB was validated in a population that also was not measured at a uniform period of time from diagnosis. The authors are not aware of any current QoL study using the FAQL-PB or the European Food Allergy Quality of Life Questionnaire family that does capture QoL at a uniform time from diagnosis in every patient. Further, the study examined only cross-sectional QoL and not longitudinal QoL, which can change over time.

In conclusion, the authors have shown that caregiver food allergy QoL is dependent on several key factors, in particular an accurate perception of reaction severity, the number of allergens, and the type of food allergen. Caregivers with inaccurate perception, lower income, children with comorbid eczema, children with multiple food allergies, children with older age at onset of the initial reaction, and caregivers reporting their child had anaphylaxis had a worse QoL reflected by a higher index score. Reaction misperception in particular is an area deserving further exploration to develop themes for potential intervention, possibly using a self-regulation-based tool shown in a previous study to be effective in moderating QoL.³³ Mean and domain-specific QoL scores for caregivers of milk- or egg-allergic children were significantly worse compared with those of children with peanut or tree nut allergy, a previously unreported finding. Further research is needed to continue to explore what might contribute to poor caregiver QoL, because poor QoL is a growing secondary effect noted in food-allergic families. It is important to focus education on caregiver understanding of what constitutes anaphylaxis and how this should be managed, because this can modify QoL. Recent research from the authors supports self-regulated intervention as a way to improve food allergy-related QoL in parents of children with food allergy.³³ Additional, specific efforts may be required for caregivers of egg- or milk-allergic parents because these allergens may be associated with worse QoL than others. With identification of risk factors for poor QoL, interventions can be tailored to the family, which may improve the QoL in caregivers of food-allergic children.

Supplementary Data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.anai.2014.04.016>.

References

- [1] Gupta RS, Springston EE, Warrier MR, et al. The prevalence, severity, and distribution of childhood food allergy in the United States. *Pediatrics*. 2011; 128:e9–e17.
- [2] Sicherer SH, Sampson HA. 9. Food allergy. *J Allergy Clin Immunol*. 2006;117: S470–S475.
- [3] Sicherer SH, Noone SA, Munoz-Furlong A. The impact of childhood food allergy on quality of life. *Ann Allergy Asthma Immunol*. 2001;87:461–464.
- [4] Ostblom E, Egmar AC, Gardulf A, Lilja G, Wickman M. The impact of food hypersensitivity reported in 9-year-old children by their parents on health-related quality of life. *Allergy*. 2008;63:211–218.
- [5] Cummings AJ, Knibb RC, Erlewyn-Lajeunesse M, King RM, Roberts G, Lucas JS. Management of nut allergy influences quality of life and anxiety in children and their mothers. *Pediatr Allergy Immunol*. 2010;21:586–594.
- [6] Springston EE, Smith B, Shulruff J, Pongracic J, Holl J, Gupta RS. Variations in quality of life among caregivers of food allergic children. *Ann Allergy Asthma Immunol*. 2010;105:287–294.
- [7] Lebovidge JS, Stone KD, Twarog FJ, et al. Development of a preliminary questionnaire to assess parental response to children's food allergies. *Ann Allergy Asthma Immunol*. 2006;96:472–477.
- [8] Wassenberg J, Cochard MM, Dunngalvin A, et al. Parent perceived quality of life is age-dependent in children with food allergy. *Pediatr Allergy Immunol*. 2012;23:412–419.
- [9] Flokstra-de Blok BMJ, Dubois AEJ. Quality of life measures for food allergy. *Clin Exp Allergy*. 2012;42:1014–1020.
- [10] Weber TK, Speridiao Pda G, Sdepanian VL, Neto UF, de Moraes MB. The performance of parents of children receiving cow's milk free diets at identification of commercial food products with and without cow's milk. *J Pediatr (Rio J)*. 2007;83:459–464.
- [11] Arkwright PD, Farragher AJ. Factors determining the ability of parents to effectively administer intramuscular adrenaline to food allergic children. *Pediatr Allergy Immunol*. 2006;17:227–229.
- [12] Bohlke K, Davis RL, DeStefano F, Marcy SM, Braun MM, Thompson RS. Epidemiology of anaphylaxis among children and adolescents enrolled in a health maintenance organization. *J Allergy Clin Immunol*. 2004;113:536–542.
- [13] Gupta RS, Springston EE, Smith B, et al. Food allergy knowledge, attitudes, and beliefs of parents with food-allergic children in the United States. *Pediatr Allergy Immunol*. 2010;21:927–934.
- [14] Yocum MW, Butterfield JH, Klein JS, Volcheck GW, Schroeder DR, Silverstein MD. Epidemiology of anaphylaxis in Olmsted County: a population-based study. *J Allergy Clin Immunol*. 1999;104:452–456.
- [15] Boyce JA, Assaad A, Burks AW, et al. Guidelines for the diagnosis and management of food allergy in the United States: summary of the NIAID-Sponsored Expert Panel Report. *J Allergy Clin Immunol*. 2010;126:1105–1118.
- [16] Lieberman P, Nicklas RA, Oppenheimer J, et al. The diagnosis and management of anaphylaxis practice parameter: 2010 update. *J Allergy Clin Immunol*. 2010;126:477–480. e1–42.
- [17] Jacobs TS, Greenhawt MJ, Hauswirth D, Mitchell L, Green TD. A survey study of index food-related allergic reactions and anaphylaxis management. *Pediatr Allergy Immunol*. 2012;23:582–589.
- [18] Greenhawt MJ, McMorris MS, Furlong TJ. Self-reported allergic reactions to peanut and tree nuts occurring on commercial airlines. *J Allergy Clin Immunol*. 2009;124:598–599.
- [19] Arslan G, Lind R, Olafsson S, Florvaag E, Berstad A. Quality of life in patients with subjective food hypersensitivity: applicability of the 10-item short form of the Nepean Dyspepsia Index. *Dig Dis Sci*. 2004;49:680–687.
- [20] Marklund B, Ahlstedt S, Nordstrom G. Health-related quality of life in food hypersensitive schoolchildren and their families: parents' perceptions. *Health Qual Life Outcomes*. 2006;4:48.
- [21] Manassis K. Managing anxiety related to anaphylaxis in childhood: a systematic review. *J Allergy (Cairo)*. 2012;2012:316296.
- [22] Herbert LJ, Dahlquist LM. Perceived history of anaphylaxis and parental overprotection, autonomy, anxiety, and depression in food allergic young adults. *J Clin Psychol Med Settings*. 2008;15:261–269.
- [23] Cohen BL, Noone S, Munoz-Furlong A, Sicherer SH. Development of a questionnaire to measure quality of life in families with a child with food allergy. *J Allergy Clin Immunol*. 2004;114:1159–1163.
- [24] Sampson HA. Utility of food-specific IgE concentrations in predicting symptomatic food allergy. *J Allergy Clin Immunol*. 2001;107:891–896.
- [25] Sampson HA, Munoz-Furlong A, Bock SA, et al. Symposium on the definition and management of anaphylaxis: summary report. *J Allergy Clin Immunol*. 2005;115:584–591.
- [26] Howe L, Sanders G, Greenhawt MJ. Parental perceptions of anaphylaxis in children with egg allergy. *J Allergy Clin Immunol*. 2012;129:AB32.
- [27] Jaeschke R, Singer J, Guyatt GH. Measurement of health status. Ascertaining the minimal clinically important difference. *Control Clin Trials*. 1989;10: 407–415.
- [28] Wright A, Hannon J, Hegedus EJ, Kavchak AE. Clinimetrics corner: a closer look at the minimal clinically important difference (MCID). *J Man Manip Ther*. 2012;20:160–166.
- [29] Baiardini I, Bousquet PJ, Brzoza Z, et al. Recommendations for assessing patient-reported outcomes and health-related quality of life in clinical trials on allergy: a GA(2)LEN taskforce position paper. *Allergy*. 2010;65:290–295.
- [30] Cook CE. Clinimetrics corner: the Minimal Clinically Important Change Score (MCID): a necessary pretense. *J Man Manip Ther*. 2008;16:E82–E83.
- [31] Howe LFT, Greenhawt M. Correct parental reaction perception affects quality of life in food allergy. *J Allergy Clin Immunol*. 2013;131:AB222.
- [32] Akeson N, Worth A, Sheikh A. The psychosocial impact of anaphylaxis on young people and their parents. *Clin Exp Allergy*. 2007;37:1213–1220.
- [33] Baptist AP, Dever SI, Greenhawt MJ, Polmear-Swendris N, McMorris MS, Clark NM. A self-regulation intervention can improve quality of life for families with food allergy. *J Allergy Clin Immunol*. 2012;130:263–265.e6.
- [34] Fleischer DM, Perry TT, Atkins D, et al. Allergic reactions to foods in preschool-aged children in a prospective observational food allergy study. *Pediatrics*. 2012;130:e25–e32.
- [35] Juniper EF, Guyatt GH, Willan A, Griffith LE. Determining a minimal important change in a disease-specific Quality of Life Questionnaire. *J Clin Epidemiol*. 1994;47:81–87.